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ABSTRACT

This report is a product of a workshop designed to address the question: What can be done to increase the number of underrepresented minorities in science? The question was put to the minority scientists currently supported by the Physiological Processes Program. Out of the many ideas expressed, several central themes emerged. One was the importance of interaction between established and aspiring scientists. Activities suggested for increasing interaction include mentorship, collaboration, and networking. Another theme concerned special problems of smaller institutions, particularly predominantly minority institutions. Finally, the career development of minority scientists was a recurrent theme. Mentoring was considered the most successful way to increase and retain minorities in science. Mentorship at all levels is crucial. Pre-college students need role models and mentors just as much as graduate students and post-doctoral fellows. (PR)

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DIVERSITY IN BIOLOGICAL RESEARCH

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FOREWORD

The National Science Foundation has been addressing issues and establishing programs concerning the underrepresentation of minorities in science, engineering, and technology for well over a decade. Conferences, symposia, and workshops have been held to discuss the topic from a variety of perspectives. Specific examples include: The annual meetings of Minority Research Initiation (MRI) recipients and Program Directors sponsored by the Education and Human Resources Directorate and an NSF Workshop co-sponsored by the American Society for Cell Biology in 1990(1).

For most scientists seeking support from the National Science Foundation, the point of contact is at the program level where proposals are received, evaluated, and recommended for approval or declination. Given this pivotal role, each program must seek solutions to the many problems attending minority representation in science. This year (FY91) was an opportune one for the Physiological Processes Program because the current portfolio of grantees includes twelve minority scientists. This group constitutes an invaluable resource to the Program and to NSF. It is small enough to permit full participation of each member and, although research interests are generally similar, the individuals differ markedly in other respects (age, academic experience, gender, size of home institution, etc.). To take advantage of this resource the Physiological Processes Program asked Dr. Gregory Florant, Professor of Biology at Temple University, to organize a workshop that would bring together these minority scientists in order to solicit suggestions that would help NSF meet its goal of significantly increasing the number of minority scientists by the year 2000 (2). Related objectives were to promote interaction among minority scientists in the Program and to establish avenues of communication between these scientists and NSF.

This report describes the substance of the discussions by the workshop members and summarizes their recommendations to increase the number of underrepresented students in the pipeline. Recommendations of the participants are under consideration by the Program and the NSF.

The opinions expressed are primarily those of the participants and do not represent NSF policy.

The National Science Foundation expresses its gratitude to Dr. Florant and to all workshop participants for their diligence and willingness to express and share their ideas as well as make valuable contributions with candor.

NATIONAL SCIENCE FOUNDATION
DIRECTORATE FOR BIOLOGICAL SCIENCES

December 30, 1991

Walter Massey
Director
National Science Foundation
Washington, D.C.

Dear Walter:

I am pleased to submit to you the report from the experts who participated in the National Science Foundation Workshop on Diversity in Biological Research.

Held in July of 1991, the workshop was comprised of twelve distinguished investigators who are members of underrepresented groups in the discipline of Physiology. The participants developed recommendations to the National Science Foundation concerning actions that can be taken to enhance the participation by minorities.

Mary

Mary E. Clutter
Assistant Director
Biological Sciences

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EXECUTIVE SUMMARY

The question addressed by this workshop was: what can be done to increase the number of underrepresented minorities in science? The question was put to the minority scientists currently supported by the Physiological Processes Program, a group uniquely suited to identify the problems faced by minorities in becoming practicing scientists. Out of the many ideas expressed, several central themes emerged. One was the importance of interaction between established and aspiring scientists. Suggested activities include mentorship, collaboration, and networking. Another theme concerned special problems of smaller institutions, particularly predominantly minority institutions. Finally the career development of minority scientists was a recurrent theme.

The issue of mentorship entered into nearly every discussion. In the context of this workshop, this coincides with the recognized importance of role models in society for members of underrepresented groups. Mentorship is more than just teaching. It combines personal involvement, commitment, attainment of goals, and followup. It was noted that mentorship occurs at many levels ranging from outreach to elementary school children on up to helping faculty colleagues fulfill their potential. Effective mentoring, however, demands both time and energy. Unfortunately, because success in academic science is often measured by grant dollars and numbers of published papers, the incentive to engage in mentorship activities has been substantially reduced. It is strongly recommended that this be corrected by according effective mentorship a more important place in measuring achievement.

Collaboration can also help minority scientists interact and grow professionally. Collaborative efforts can combine skills needed to solve difficult research problems or can accelerate acquisition of new skills. Of particular importance is the opportunity for minority scientists at smaller institutions to grow and participate in science above the level of observer. Collaboration can also help young minority scientists bridge the gap between "start up" targeted programs and "mainstream" independent research projects. Networking among members of the minority community expands opportunities for mentorship and collaboration.

The special problems of predominantly minority institutions are particularly important because students at these institutions constitute a major pool from which future minority scientists will come. To tap this resource, science education must be improved at these institutions, excellent faculty must be recruited as role models, and these faculty must be given every opportunity to reach their potential as scientists and mentors. At present, however, heavy teaching loads, limited facilities, and inadequate institutional support are major problems.

Involvement of minorities on panels, as rotating program directors, and in other NSF activities heightens understanding of minority problems by the Foundation and other scientists.

INTRODUCTION

The Workshop on Diversity in Biological Research met in Washington, D.C. on July 11 and 12, 1991. The charge to the members of the workshop panel was to provide advice to the NSF on two related questions: 1) How can the number of underrepresented minorities in science and engineering be increased? 2) What can be done to optimize professional growth of current minority scientists? The second question bears on the first because current minority scientists are the role models for future scientists. Some of the participants have been involved in promoting minority participation in science for over twenty years. The opportunity for these senior scientists to share their experiences with younger counterparts was a major feature of the meeting.

The severity of the problem is well documented. Blacks, Hispanics and Native Americans make up over twenty percent of the U.S. population but earned only 6.4 percent of awarded doctorates in 1988. The statistics are even more alarming if one focuses on Natural Sciences and Engineering (NS&E). Out of 14,000 NS&E doctorates awarded in 1988, only 308 (2.2 percent) were granted to underrepresented minorities (3). Within the microcosm of the Physiological Processes Program, about 1,100 research proposals have been reviewed over the last three years. Only 38 or 3.4 percent of these were submitted by identifiable underrepresented minorities. At present, about six percent of current awardees in the Progam are underrepresented minorities.

For more than a decade, NSF has sponsored programs that facilitate the entry and retention of minority scientists into science and engineering research. These programs include Minority Research Initiation (MRI), Research Improvement in Minority Institutions (RIMI), and Minority Research Centers of Excellence (MRCE).

Other special programs targeted for members of minority groups that are underrepresented in science and engineering have been added through the years. Examples include: Alliances for Minority Participation (AMP), Research Careers for Minority Scholars (RCMS), Research Opportunities for Minority Students and College Faculty, Research Planning Grants, CISE Institutional Infrastructure-Minority Institutions Career Advancement Awards, Research Initiation Awards and several fellowship programs.

In 1989, an NSF Committee studied the role of NSF in attracting minorities to careers in Science and Engineering (2). Three recommendations from that report are particularly pertinent to the objectives of the present workshop. First was the need to establish alliances between the Foundation and educational institutions, industry, and Government bodies. Second was the important responsibility of the "Science Directorates" in the Foundation for attracting and retaining minorities. Third were definitive goals for the next decade: raise the number of NS&E doctorates from 300 to 2,000 per year, the number of NS&E B.S. degrees from 14,000 to 50,000 per year, increase underrepresented minority faculty from the current 3,800 to at least 6,000.

ISSUES AND GOALS

PRE-COLLEGE LEVEL ISSUES

Most agree that students need to be reached at the elementary school level to awaken their interest in the sciences. At this formative stage the largest impact may be achieved to encourage young people to pursue careers in the sciences. Methods in current use are not working and need to be improved for all students. Several issues were raised by the Workshop participants reflecting, in many cases, their own experiences:

- Lack of minority role models as teachers and counselors.
- Limited opportunity for students to see what scientists do or what they are like as people.
- Limited understanding of parents about science as a career.
- Limited awareness of parents, students and counselors of availablility of resources to help finance education.
- Stereotyping of students by ethnicity—tendency to put minorities into vocational programs or otherwise track students.
- Failure of universities to "reach" minorities in high schools and community colleges.
- Concern about the time commitment to education.

UNDERGRADUATE ISSUES

As noted in the Introduction above, the Committee on the National Science Foundation's Role in Attracting Minorities to Careers in NS&E (2) recommended that the rate of production of minority Ph.D.s in NS&E be increased by a factor of six (308 to 2,000) by the year 2000. Given the time required to complete a doctoral program, it is clear that the students needed to meet that goal are now freshman or sophmores in college. This is a pool of approximately 1.2 million students (there are about 2 million Blacks, Hispanics and Native Americans currently enrolled in two-year and four-year undergraduate colleges) (4). We need to try to encourage about one-half of one percent of this pool to seriously consider graduate education in science and engineering. This is a sizeable but not impossible task.

There is an urgent need to address the problems of predominantly minority institutions which enroll about 20% of all minority students and an even higher percentage of those minorities who enter careers in science (2). These minority institutions are known for their nurturing environment as compared to the perceived more hostile, indifferent environment of many majority universitites. Enrollment is on the rise in most predominantly minority schools and larger numbers of "high achievers" are choosing these schools over majority institutions (5).

It is a myth that predominantly minority institutions receive favorable treatment from government agencies and are well funded. In fact, many of these institutions are chronically underfunded, do not have major endowments, and have only limited facilities for science education. Faculty frequently have heavy teaching loads and limited time for independent research.

Minority students enrolled in majority institutions should not be ignored since about 48% are currently enrolled at two-year community colleges (4). There is a great need to facilitate the transition between the two- and four-year colleges.

GRADUATE SCHOOL ISSUES

Factors affecting the decision to attend graduate school include financial considerations, the time commitment required (including post-doctoral training), and the uncertain job market. In 1987, the median time to complete the doctorate from the baccalaureate degree was 6.9 years (all disciplines); it was about 6.1 years for the sciences (6). Secure, sustained financial support must be a

key element in any consideration of graduate education. Such support should be tied to an effective program for the student that goes beyond service as a laboratory technician.

GOALS

1. Increase the number of minorities on panels and in service as program officers.
2. Increase NSF's interaction with minority institutions and small but excellent teaching institutions.
3. Develop networking databases within the academic community on all levels.
4. Enhance collaboration among the new scientists and established investigators (mentorship).
5. Enhance communication between NSF program officers and the minority community.

STRATEGIES

STRONG MENTORING PROGRAM

The search for solutions to some of the broader problems are beyond the scope of this workshop (improved teacher education, new teaching methods, better facilities, etc.) These problems are better addressed by the Education and Human Resources (EHR) Directorate of NSF.

Minority scientists can serve a special function by becoming involved with local educational activities. Many are parents and have a vested interest in such particpation. In doing so they serve as role models for students, other parents, teachers, and administrators. Avenues of participation can include visits to classrooms, science fairs, and parent-teacher association meetings. Many scientists trace their interest in science to jobs in research laboratories during their high school years. In this decade, many universities have provided special summer programs in mathematics and science for minority students. Opportunities for minority high school students should be expanded in this respect and supplemental funds for scientists who are willing to actively recruit such students should be made readily available.

Mentorship is one of the earliest forms of education but its unique effectiveness in widening the pipeline of minority scientists has only recently been recognized. It involves personal involvment, long term committment, and followup. It was noted repeatedly during this Workshop that mentorship occurs at many levels ranging from early elementary education through helping fellow faculty members fulfill their potential and, in turn, become effective mentors themselves.

There should be TWO areas of emphasis in the mentorship program.

a. Students

b. Young faculty

Minority scientists as is true of all others can exert their greatest impact through mentoring undergraduate students. The NSF provides a mechanism known as the Research Experience for Undergraduates (REU). In 1991, the Physiological Processes Program supported 39 undergraduates through REU supplements; six were minorities (7). Since undergraduates supported by REU supplements need not stem from the same institution as the PI, an opportunity to establish special relationships with predominantly minority institutions is made possible.

Although initiation of mentorship occurs most frequently within the institution at which mentor and the person being mentored work and study, it is also possible to initiate this kind of relationship by means of networking through the Scientific Societies that have already established committees on Minority Affairs. Many scientific societies offer undergraduates as well as graduate students the opportunity to present posters or papers at their meetings.

The hallmark of graduate education is one-on-one interactions between the major professor and the student. Minority faculty have a special responsibility to sensitize their non-minority faculty colleagues to special problems that may arise in mentoring minority students. Mentorship need not be limited by the walls of one's own institution. Collaborative interactions between minority scientists might include exchange visits of graduate students. Spending part of a summer at a field station can be a most exciting experience for a graduate student.

CAREER DEVELOPMENT

The initial years of an academic appointment are stressful to anyone but can be devastating for minorities who frequently find themselves the only minority in a given department. They are inundated by requests to serve on committees in the interest of ethnic balance. Of course, at universities and at an increasing number of undergraduate colleges, establishment and maintenance

of an actively funded research program is expected. Guidance from colleagues, mentors, and administrators can make the difference between success and failure.

Many things can be done to ease the problem; some by the networks of minority faculty (intramural and extramural), others by college administrators and granting agencies. These include:

A. Encourage mentorship of junior faculty by senior faculty such that priorities and potential problems are made known.

B. Sensitize administrators, faculty, and granting agencies to the problems.

C. Improve communication between funding agencies and potential applicants with respect to sources of funding.
   - Agencies should tap into existing graduate education networks (Minority Graduate Education Project, for example) and apprise senior graduate students and postdoctoral fellows of funding opportunities.
   - Extend network to Minority Affairs Offices at Universities. Many universities are unaware of programs targeted to minorities.
   - NSF should expand sponsorship of booths at national meetings and include meetings of minority scientists.
   - Encourage minority scientists to call or visit NSF Program Officers regarding application procedures, average award size, and appropriateness of proposal for specific programs.
   - Encourage experienced mentors to advise applicants about proposals, check for errors, confusing statements, feasibility, etc.
   - Involve more minority scientists in the operation of funding agencies as panelists, program officers and workshop participants.
   - Encourage potential Principal Investigators to consult with home institutions regarding time commitment for project, possibility of released time, ancillary support and availability of facilities before preparing a proposal.

D. Improve Retention of Minority Scientists

Most federal agencies make a special effort to help beginning scientists, minorities as well as non-minorities. After that they are on their own. It is important to find ways to smooth the transition between first grants and the "mainstream" competition. There are two key elements that bear on success of renewal applications. The first is demonstrated accomplishments over the previous grant period; the second is development of new ideas for the next grant period.

Collaboration between scientists is an important mechanism through which minority scientists can interact and grow professionally. In many cases, a collaborative effort can greatly accelerate the learning of new skills. It is particularly important that young minorities at smaller universities and colleges have the opportunity to participate in sciences at a level above that of an observer.

Networking among members of the minority community expands opportunities for mentoring and collaboration. Workshop paticipants plan to interact with other "networks" of minorities in professional societies.

The premise underlying this Workshop was that scientists working at the "front line" can play a significant role in attracting minorities into science and engineering. To do this, there must be an ongoing effort to raise the issue in the minds of the scientific community. Because it has the ear of a large segment of this community, it is in an ideal position to facilitate this process and has done so over the years. However, most scientists interact with NSF at the Program level. This Workshop was an effort on the part of one Program to reaffirm its commitment to finding solutions to the problem.

SUMMARY

The unifying theme of this workshop was clear: mentoring was the most successful way to increase and retain minorities in science. Mentorship at all levels is crucial. Pre-college students need role models and mentors just as much as graduate students and post-doctoral fellows.

Coupled with mentoring is financial support. In order to mentor or be mentored, students and faculty must be freed from other commitments and distractions, such as second jobs, or lack of research funds. Consequently, NSF must be prepared to commit funds for such mentorship programs from pre-college through faculty positions (as currently outlined in the Alliances for Minority Participation Program). Only in this way will students be retained in science and mentors will remain dedicated to this cause.

Finally, we, the participants, are proud of the support and the efforts being made in the Physiological Processes Program.

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